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Central States Forest Experiment Station

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DETECTING HIDDEN METAL IN WOOD WITH THE SCR-625 ARMY MINE DETECTOR

Revised October 1949

BRIEF DESCRIPTION OF DETECTOR

Several types of electronic military mine detectors were developed for the U. S. Army during World War II. The type designated as the SCR-625, (fig. 1, page 5) is the most sensitive of any type released for sale as surplus and has proved to be an effective device for detecting concealed nails and other metal in trees, logs, flitches, timbers, and the like. The detector operator moves the disk-shaped search head back and forth close to the log surface. This head is activated by a radio-like mechanism called the amplifier which is carried by the operator in a case suspended on shoulder straps. Any metal object in the path of the search head causes a "howling" tone signal in the connected earphones. A miniature loud-speaker, called a resonator, can be used in place of the earphones under favorable conditions. The operating procedures described below are based on numerous field trials of SCR-625 detectors in the Central States Hardwood and adjoining regions.

ASSEMBLY, ADJUSTMENTS, AND REPAIRS

A printed, illustrated Army Technical Manual is provided with each SCR-625 detector set. It describes the component parts in detail, shows how to assemble the instrument, explains the operating principle, and gives instructions for adjustments and repairs.

Competent radio repairmen in local shops can adjust and repair SCR-625 detectors satisfactorily after reviewing the Army Technical Manual sections under "Functioning of Parts" and "Maintenance."

PLACE OF USE

GENERAL - Magnetic interference is encountered within 3 to 6 feet of large masses of metal such as steel rails, railroad car wheels, auto-truck chassis,





and reinforcing steel in concrete walls and floors; and at greater distances from live power-lines, transformers, and operating motors and generators. Detector operators can readily determine by trial where the instrument can and cannot be used with reference to such sources of interference.

Magnetic disturbances are usually encountered when the search head is held close to the ground. The amount of such interference varies by localities. It will seldom be severe enough, however, to prevent effective search of logs on the ground by the "TOP-THIRD" procedure explained in this report.

Noisy surroundings make it difficult to hear tone signals from the resonator, which is mounted on the operator's shoulder at a distance of 2 or 3 inches from his right or left ear. The earphone headset should be used in such situations. Even in quiet surroundings, a better job of detecting can be done with the earphones because weaker signals can be heard with them than with the resonator.

IN THE WOODS - By using the long handle provided with the SCR-625 butt logs can be searched readily in the standing tree as high as the operator can reach with the search head. The searching of felled trees in the woods before bucking has the disadvantage that the under side cannot be scanned effectively. Searching of logs in the woods can generally be done most efficiently where the logs are loaded for transportation to the mill.

AT THE MILL - Mill landings where logs are dumped from wagons, trucks, or cars are good places for searching logs. Searching at these landings may require some modification of log-handling methods. Where ground-surface magnetic interference is pronounced, the installation of log or timber rollways will help by increasing the distance between the ground and the working level of the detector search head. Another good place is the log rollway leading to the sawmill carriage. Obviously there should be no steel rails, bolts, nails, or other metal on or directly beneath that part of the rollway where the detector searching is done.

Flitches, boards, and other small pieces can be searched at mills by passing them over short, wooden skids or platforms which will keep the material a foot or two above the ground surface, or at least 3 feet above a floor containing reinforcing steel, large nails, or bolts. Flitches cut for veneer manufacture can be searched for metal either directly after coming from the sawmill or when en route to the veneer machine. The choice will depend on the set-up at a particular mill.

The SCR-625 is ideal for searching timbers and lumber salvaged from old buildings and other structures. Searching can be done either at the site where all visible nails and bolts are being removed, or at concentration points where the second-hand material is resawed, ripped, or crosscut.

Wood floating in water can be searched in place provided there is no interference from outside metal such as boom chains. In narrow vats





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such as those used for heating veneer logs and flitches, there is not likely to be enough space between the concrete sidewalls to get away from the strong interference caused by the reinforcing steel.

**SHADE TREES** - Shade-tree operators can avoid damage to hand and power cutting tools by pre-searching sections where cutting is to be done, for example at bases of branches that are to be pruned, or bored for reinforcing hardware. The detector is especially useful in connection with removal of shade trees from city premises where it is advantageous to cut trunk and large branches into many short sections with a chain saw. Hidden hazards such as wire, staples, nails, and screw hooks are far more frequent in park and home-site trees than in forest-grown trees.

#### ROUTINE OPERATION OF THE DETECTOR

**GENERAL** - Handle the detector carefully at all times, it is a delicate instrument. Avoid banging the search-coil disk or any other part of the apparatus against logs or other objects, and never toss any of the components carelessly on the ground or floor.

Turn the switch off on the control box whenever the detector is not actually in use, even when stoppages are short. Batteries will remain effective much longer if the detector operator forms the habit of turning the switch off whenever it appears that the instrument will be idle for 1 minute or longer.

When the detector is used for a number of days in one limited location, it need not be repacked in its carrying case when not in use. It should, however, be left in a dry, well-protected shelter where it will not be accidentally damaged or handled by curious persons who know nothing about it. The main plug connection between control box and amplifier should be pulled apart as a precaution against depleting the batteries if the control-box switch happens to be left on.

Each morning before starting to use the detector test it by passing the search head back and forth about 10 inches from the end of an 8-penny nail that is perpendicular to the flat face of the disk. The tone signal, although not loud, should be distinct.

**SEARCHING TECHNIQUE AND PROCEDURE** - Assuming that the detector is in good working order as shown by the daily test, and that the place of searching is free from severe outside interference, the search coil should be held 4 feet or more above the ground level and the tone reduced to a minimum by turning the compensation control knobs on the control box. This will need to be done from time to time as searching proceeds since the tone has a tendency to drift as the detector is moved about.

The search-head disk should be moved back and forth parallel with, and about 1 inch away from, the surface of the log or other material being scanned. The operator should proceed slowly at first, keeping his eye on the disk to avoid bumping it against the wood or bark. Searching speed will increase with practice. The path of effective searching is about equal to





the width of the disk. This limitation must be kept in mind, particularly when searching trees and logs of large circumference.

The tone signals indicating metal are affected by both the size of the metal object and its depth in the log (distance in inches from the face of the search head). The detector operator must concentrate on his job to catch slight signals, particularly when larger logs are being searched. The dial indicator (on all models except SCR-625 H) on the control box can be watched in lieu of using either resonator or earphones. However, the dial indicator is not as sensitive to slight disturbances as is the tone signal. Furthermore, watching the dial interferes with watching the search head as it is moved along the log. Reliance on tone signals will give the best results under most conditions found in the Central States region.

Rocks, cinders, and accumulations of dirt or mud on the bark of a log will frequently give tone signals as loud as those from metal near the surface. Occasional accumulations can be removed by hand, but when hand cleaning is not feasible logs will have to be washed in advance of searching. Another alternative is to do the searching before dirt is picked up by the bark.

Small metallic objects, such as buck shot and tacks, that occur in or just under the bark will produce characteristic staccato signals as the disk is passed back and forth above them. WHEN A SIGNAL IS OBTAINED AND THE APPARENT CENTER OF A DISTURBANCE IS SPOTTED THE SURFACE SHOULD BE CLOSELY EXAMINED. IF BARK IS PRESENT A FAIR-SIZED SECTION THEREOF SHOULD BE REMOVED AND THE EXPOSED WOOD TESTED AGAIN. If there is no longer any signal it will be obvious that the cause of the disturbance was in the bark. Removal of bark may disclose a recently driven nail, possibly covered with dirt or moss in the bark grooves. When a metal object has been removed by chopping, ALWAYS TEST THE AREA AGAIN TO BE SURE THAT NO ADDITIONAL METAL IS UNDER OR ADJACENT TO THAT REMOVED.

Probably 95 percent or more of all hidden metal in timber normally occurs in butt logs. As a general rule it is therefore suggested that detector search be confined to butt logs. Other logs can be watched for suspicious-appearing bumps and scars, and searched only in the immediate vicinity of such bumps and scars.

In the woods, procedures can be worked out which will minimize the searching job. In the remote backwoods very little searching is needed. When trees cut are close to houses, farm buildings, public parks, or camping grounds every tree may warrant searching. The "TOP-THIRD" procedure is recommended for searching logs 14 inches and larger in diameter (fig. 1, page 5). This procedure involves three steps: (1) search top third of the log cylinder; (2) roll log  $\frac{1}{3}$  of its circumference which will place the next  $\frac{1}{3}$  cylinder uppermost for searching; (3) roll log another  $\frac{1}{3}$  circumference and complete search of remaining  $\frac{1}{3}$  cylinder. Crayon marks placed on one end of each log prior to searching will serve as a guide in rolling and in obtaining proper coverage with the search head. Logs 13 inches and

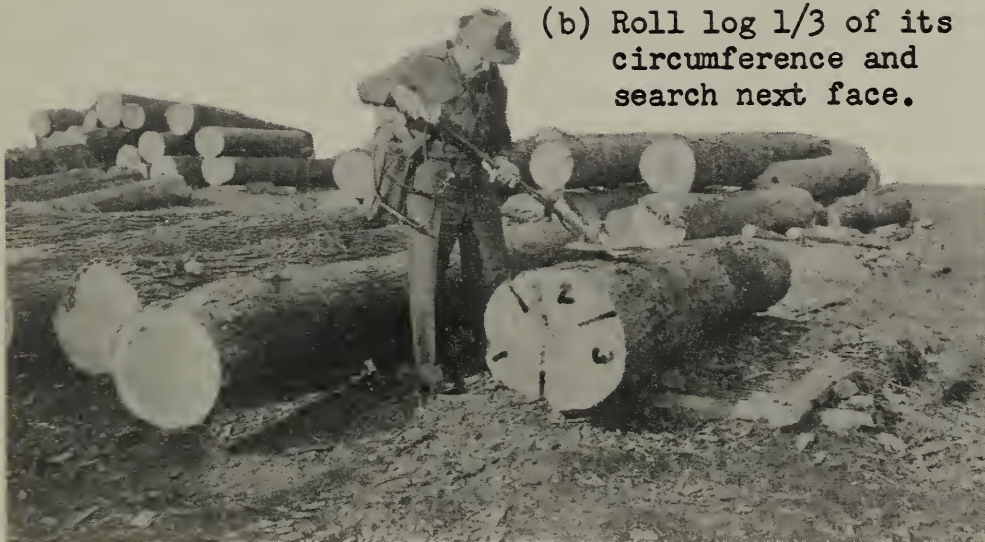




(a) Search top-third face of log.



(b) Roll log  $\frac{1}{3}$  of its circumference and search next face.



(c) Roll last face up and complete search.



Figure 1.--"Top-third" procedure for searching logs on the ground. Sectors are numbered 1, 2, and 3 for illustration only. A log of this size requires 3 passes of the search head along the log length for each face (space between adjacent radial marks) since the effective path is only the width of the search head.





smaller in diameter can usually be searched effectively by passing the disk over the top half once, rolling 180 degrees and repeating. Magnetic interference from the ground surface may in some instances be too strong to permit efficient scanning of logs smaller than 13 or 14 inches in diameter unless they are raised a few inches on wooden stringers.

It is good practice to scan the butt-end cross sections of butt logs 16 inches or larger in butt-cut diameter (i.e., pass the search head in a vertical position back and forth across the butt-cut surface). This is not necessary with smaller logs.

The searching of flitches 6 inches or less in thickness can be done effectively on one flat side (without turning the flitch) when the detector is in first-class working order and the place of searching is practically free from extraneous magnetic interference. However, when one-side searching indicates metal, the flitch should be turned for searching on the side opposite the initial disturbance. The strength of the signal tone locates the metal and indicates how it can be removed with the least amount of chopping. Flitches 7 to 12 inches thick should be searched on two opposite sides and those thicker than 12 inches on four sides.

In searching the lower portion of standing trees allowance must be made for ground surface interference. If ground interference is considerable, or if the stump is to be utilized (as in the case of some black walnut trees), the low limit of effective searching should be marked so that the portion below the mark can be tested again after the tree is felled. Searching for metal in the butt logs of standing trees eliminates the risk of interference from dirt in the grooves of the bark.

#### MARKING LOCATION OF CONCEALED METAL AND REMOVAL OF METAL DISCOVERED

Whether a marking system is necessary or not will depend on whether the metal is chopped out immediately after it is found or is left for later removal. When the latter system is followed it is suggested that operators of SCR-625 detectors use belt axes and soft, bright-red lumber crayon. The belt axe will be used principally for removing sections of bark from spots where the detector indicates metal on first searching. After removing bark from such spots and researching the exposed wood, the following marking system may be used:

- (1) If no further indication of metal, do not mark.
- (2) If the second search after removal of bark indicates hidden metal in the wood and the signal is definitely centered over one spot (as determined by crisscross movement of the search head) mark the spot with a red X.
- (3) If the second search indicates hidden metal which cannot be spotted at a single point (e.g., scattered nails, a long wire, etc.) mark a red zigzag line over the entire area of tone disturbance.





Chopping out deeply imbedded and widely scattered metal is costly. The amount of chopping warranted depends on the value of the raw material. Bucking out the entire section of a log which contains deeply imbedded metal will generally be the most economical practice, particularly when a power saw is available. Possibilities of utilizing metal-containing sections of logs for fuelwood, posts, or other split products should be considered in connection with each operation where a metal detector is in use.



